Practitioner's Docket No. AP9673

CHAPTER II

TRANSMITTAL LETTER TO THE UNITED STATES ELECTED OFFICE (EO/US)

(ENTRY INTO U.S. NATIONAL PHASE UNDER CHAPTER II)

PCT/EP00/01373	18/February/2000	18/February/1999
INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED

Brake Pad Comprising a Retaining Spring Device
TITLE OF INVENTION

Helmut Ruckert; Hans-Georg Keferstein
APPLICANT(S)

Box PCT
Commissioner for Patents
Washington D.C. 20231
ATTENTION: EO/US

NOTE: To avoid abandonment of the application, the applicant shall furnish to the USPTO, not later than 20 months from the priority date: (1) a copy of the international application, unless it has been previously communicated by the International Bureau or unless it was originally filed in the USPTO; and (2) the basic national fee (see 37 C.F.R. § 1.492(a)). The 30-month time limit may not be extended 37 C.F.R. § 1.495.

WARNING: Where the items are those which can be submitted to complete the entry of the international application into the

CERTIFICATION UNDER 37 C.F.R. 1.10*
*(Express Mail label number is **mandatory**.)*
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I hereby certify that this correspondence and the documents referred to as attached therein are being deposited with the United States Postal Service on this date 8-16-01, in an envelope as "Express Mail Post Office to Addressee," Mailing Label Number EL 781 401 411 US, addressed to the: Assistant Commissioner for Patents, Washington, D.C. 20231.

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2.Fees

CLAIMS FEE	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
[ ]*	TOTAL CLAIMS	13 - 20 =		x $ 18.00 =	$
	INDEPENDENT CLAIMS	1 - 3 =		x $ 78.00 =	
	MULTIPLE DEPENDENT CLAIM(S) (if applicable) + $260.00				
BASIC FEE**	[ ] U.S. PTO WAS INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where an International preliminary examination fee as set forth in § 1.482 has been paid on the international application to the U.S. PTO: [ ] and the international preliminary examination report states that the criteria of novelty, inventive step (non-obviousness) and industrial activity, as defined in PCT Article 33(2) to (4) have been satisfied for all the claims presented in the application entering the national stage (37 CFR 1.492(a)(4)) ..... $96.00 [ ] and the above requirements are not met (37 CFR 1.492(a)(1)) ..... $670.00 [X] U.S. PTO WAS NOT INTERNATIONAL PRELIMINARY EXAMINATION AUTHORITY Where no international preliminary examination fee as set forth in § 1.482 has been paid to the U.S. PTO, and payment of an international search fee as set forth in § 1.445(a)(2) to the U.S. PTO: [ ] has been paid (37 CFR 1.492(a)(2)) ..... $760.00 [ ] has not been paid (37 CFR 1.492(a)(3)) ..... $970.00 [X] where a search report on the international application has been prepared by the European Patent Office or the Japanese Patent Office (37 CFR 1.492(a)(5)) $860.00				
	Total of above Calculations				= 860.00
SMALL ENTITY	Reduction by ½ for filing by small entity, if applicable. Affidavit must be filed. (note 37 CFR 1.9, 1.27, 1.28)				-
	Subtotal				860.00
	Total National Fee				$ 860.00
	Fee for recording the enclosed assignment document $40.00 (37 CFR 1.21(h)). (See Item 13 below). See attached "ASSIGNMENT COVER SHEET".				
TOTAL	Total Fees enclosed				$ 860.00

national phase are subsequent to 30 months from the priority date the application is still considered to be in the international state and if mailing procedures are utilized to obtain a date the express mail procedure of 37 C.F.R. §1.10 must be used (since international application papers are not covered by an ordinary certificate of mailing - See 37 C.F R. §1.8.

NOTE: Documents and fees must be clearly identified as a submission to enter the national state under 35 USC 371 otherwise the submission will be considered as being made under 35 USC 111. 37 C.F R. § 1.494(f).

1. Applicant herewith submits to the United States Elected Office (EO/US) the following items under 35 U.S.C. 371:

   a. [X] This express request to immediately begin national examination procedures (35 U.S.C. 371(f)).

   b. [X] The U.S. National Fee (35 U.S.C. 371(c)(1)) and other fees (37 C.F.R. § 1.492) as indicated below:

*See attached Preliminary Amendment Reducing the Number of Claims.

i. [ ] A check in the amount of _____ to cover the above fees is enclosed.

ii. [X] Please charge Account No. 18-0013 in the amount of $ 860.00. A duplicate copy of this sheet is enclosed.

**WARNING: *"To avoid abandonment of the application the applicant shall furnish to the United States Patent and Trademark Office not later than the expiration of 30 months from the priority date: * * * (2) the basic national fee (see § 1.492(a)). The 30-month time limit may not be extended." 37 C.F.R. § 1.495(b).*

WARNING: *If the translation of the international application and/or the oath or declaration have not been submitted by the applicant within thirty (30) months from the priority date, such requirements may be met within a time period set by the Office. 37 C.F.R. § 1.495(b)(2). The payment of the surcharge set forth in § 1.492(e) is required as a condition for accepting the oath or declaration later than thirty (30) months after the priority date. The payment of the processing fee set forth in § 1.492(f) is required for acceptance of an English translation later than thirty (30) months after the priority date. Failure to comply with these requirements will result in abandonment of the application. The provisions of § 1.136 apply to the period which is set. Notice of Jan. 3, 1993, 1147 O.G. 29 to 40.*

3. [X] A copy of the International application as filed (35 U.S.C. 371(c)(2)):

NOTE: *Section 1.495 (b) was amended to require that the basic national fee and a copy of the international application must be filed with the Office by 30 months from the priority date to avoid abandonment "The International Bureau normally provides the copy of the international application to the Office in accordance with PCT Article 20. At the same time, the International Bureau notifies applicant of the communication to the Office. In accordance with PCT Rule 47.1, that notice shall be accepted by all designated offices as conclusive evidence that the communication has duly taken place. Thus, if the applicant desires to enter the national stage, the applicant normally need only check to be sure the notice from the International Bureau has been received and then pay the basic national fee by 30 months from the priority date." Notice of Jan. 7, 1993, 1147 O.G. 29 to 40, at 35-36. See item 14c below.*

a. [X] is transmitted herewith.

b. [ ] is not required, as the application was filed with the United States Receiving Office.

c. [ ] has been transmitted

i. [ ] by the International Bureau.
Date of mailing of the application (from form PCT/IB/308): _____.

ii. [ ] by applicant on _____.
Date

4. [X] A translation of the International application into the English language (35 U.S.C. 371(c)(2)):

a. [X] is transmitted herewith.

b. [ ] is not required as the application was filed in English.

c. [ ] was previously transmitted by applicant on _____.
Date

d. [ ] will follow.

5. [ ] Amendments to the claims of the International application under PCT Article 19 (35 U.S.C. 371(c)(3)):

NOTE: *The Notice of January 7, 1993 points out that 37 C.F.R. § 1.495(a) was amended to clarify the existing and continuing practice that PCT Article 19 amendments must be submitted by 30 months from the priority date and this deadline may not be extended. The Notice further advises that: "The failure to do so will not result in loss of the subject matter of the PCT Article 19 amendments. Applicant may submit that subject matter in a preliminary amendment filed under section 1.121. In many cases, filing an amendment under section 1.121 is preferable since grammatical or idiomatic errors may be corrected." 1147 O.G 29-40, at 36.*

a. [ ] are transmitted herewith.
b. [ ] have been transmitted
   i. [ ] by the International Bureau.
   Date of mailing of the amendment (from form PCT/IB/308): _____.
   ii. [ ] by applicant on _____.
   Date
c. [ ] have not been transmitted as
   i. [ ] applicant chose not to make amendments under PCT Article 19.
   Date of mailing of Search Report (from form PCT/ISA/210): _____.
   ii. [ ] the time limit for the submission of amendments has not yet expired. The amendments or a statement that amendments have not been made will be transmitted before the expiration of the time limit under PCT Rule 46.1.

6. [ ] A translation of the amendments to the claims under PCT Article 19 (38 U.S.C. 371(c)(3)):
   a. [ ] is transmitted herewith.
   b. [ ] is not required as the amendments were made in the English language.
   c. [ ] has not been transmitted for reasons indicated at point 5(c) above.

7. [x] A copy of the international examination report (PCT/IPEA/409)
   [x] is transmitted herewith.
   [ ] is not required as the application was filed with the United States Receiving Office.

8. [X] Annex(es) to the international preliminary examination report
   a. [X] is/are transmitted herewith.
   b. [ ] is/are not required as the application was filed with the United States Receiving Office.

9. [ ] A translation of the annexes to the international preliminary examination report
   a. [ ] is transmitted herewith.
   b. [ ] is not required as the annexes are in the English language.

10. [X] An oath or declaration of the inventor (35 U.S.C. 371(c)(4)) complying with 35 U.S.C. 115
   a. [ ] was previously submitted by applicant on _____.
   Date
   b. [ ] is submitted herewith, and such oath or declaration
      i. [ ] is attached to the application.
      ii. [ ] identifies the application and any amendments under PCT Article 19 that were transmitted as stated in points 3(b) or 3(c) and 5(b); and states that they were reviewed by the inventor as required by 37 C.F.R. 1.70.

iii. [X] will follow.

Other document(s) or information included:

11. [x] An International Search Report (PCT/ISA/210) or Declaration under PCT Article 17(2)(a):
   a. [x] is transmitted herewith.
   b. [ ] has been transmitted by the International Bureau.
      Date of mailing (from form PCT/IB/308): _____.
   c. [ ] is not required, as the application was searched by the United States International Searching Authority.
   d. [ ] will be transmitted promptly upon request.
   e. [ ] has been submitted by applicant on _____.
      Date

12. [X] An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98:
   a. [X] is transmitted herewith.
      Also transmitted herewith is/are:
      [X] Form PTO-1449 (PTO/SB/08A and 08B).
      [X] Copies of citations listed.
   b. [ ] will be transmitted within THREE MONTHS of the date of submission of requirements under 35 U.S.C. 371(c).
   c. [ ] was previously submitted by applicant on _____.
      Date

13. [ ] An assignment document is transmitted herewith for recording.

A separate [ ] "COVER SHEET FOR ASSIGNMENT (DOCUMENT) ACCOMPANYING NEW PATENT APPLICATION" or[ ] FORM PTO 1595 is also attached.

_____
_____
_____

14. [X] Additional documents:
   a. [ ] Copy of request (PCT/RO/101)
   b. [x] International Publication No. WO00/49307
      i. [ ] Specification, claims and drawing
      ii. [x] Front page only
   c. [X] Preliminary amendment (37 C.F.R. § 1.121)
   d. [ ] Other

_____
_____
_____

15. [X] The above checked items are being transmitted

a. [X] before 30 months from any claimed priority date.
b. [ ] after 30 months.

16. [ ] Certain requirements under 35 U.S.C. 371 were previously submitted by the applicant on _____, namely:

_____
_____
_____

AUTHORIZATION TO CHARGE ADDITIONAL FEES

WARNING: *Accurately count claims, especially multiple dependent claims, to avoid unexpected high charges if extra claims are authorized.*

NOTE: "A written request may be submitted in an application that is an authorization to treat any concurrent or future reply, requiring a petition for an extension of time under this paragraph for its timely submission, as incorporating a petition for extension of time for the appropriate length of time. An authorization to charge all required fees, fees under § 1.17, or all required extension of time fees will be treated as a constructive petition for an extension of time in any concurrent or future reply requiring a petition for an extension of time under this paragraph for its timely submission. Submission of the fee set forth in § 1.17(a) will also be treated as a constructive petition for an extension of time in any concurrent reply requiring a petition for an extension of time under this paragraph for its timely submission." 37 C.F.R. § 1.136(a)(3).

NOTE: "Amounts of twenty-five dollars or less will not be returned unless specifically requested within a reasonable time, nor will the payer be notified of such amounts; amounts over twenty-five dollars may be returned by check or, if requested, by credit to a deposit account." 37 C.F.R. § 1.26(a).

[X] The Commissioner is hereby authorized to charge the following additional fees that may be required by this paper and during the entire pendency of this application to Account No. 18-0013.

[X] 37 C.F.R. 1.492(a)(1), (2), (3), and (4) (filing fees)

WARNING: *Because failure to pay the national fee within 30 months without extension (37 C.F.R. § 1.495(b)(2)) results in abandonment of the application, it would be best to always check the above box.*

[X] 37 C.F.R. 1.492(b), (c) and (d) (presentation of extra claims)

NOTE: Because additional fees for excess or multiple dependent claims not paid on filing or on later presentation must only be paid or these claims cancelled by amendment prior to the expiration of the time period set for response by the PTO in any notice of fee deficiency (37 C.F.R. § 1.492(d)), it might be best not to authorize the PTO to charge additional claim fees, except possible when dealing with amendments after final action.

[X] 37 C.F.R. 1.17 (application processing fees)
[X] 37 C.F.R. 1.17(a)(1)-(5)(extension fees pursuant to § 1.136(a).
[ ] 37 C.F.R. 1.18 (issue fee at or before mailing of Notice of Allowance, pursuant to 37 C.F.R. 1.311(b))

NOTE: Where an authorization to charge the issue fee to a deposit account has been filed before the mailing of a Notice of Allowance, the issue fee will be automatically charged to the deposit account at the time of mailing the notice of

allowance. 37 C.F.R. § 1.311(b).

NOTE: 37 C.F.R. 1.28(b) requires "Notification of any change in loss of entitlement to small entity status must be filed in the application . . . prior to paying, or at the time of paying . . . issue fee." From the wording of 37 C.F.R. § 1.28(b): (a) notification of change of status must be made even if the fee is paid as "other than a small entity" and (b) no notification is required if the change is to another small entity.

[X] 37 C.F.R. § 1.492(e) and (f) (surcharge fees for filing the declaration and/or filing an English translation of an International Application later than 30 months after the priority date).

SIGNATURE OF PRACTITIONER

Reg. No.: 33,373

Joseph V. Coppola, Sr.
(type or print name of practitioner)

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AP9673

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of: Ruckert et al.

Int'l Application No.: PCT/EP00/01373

Int'l Filing Date: 18/February/2000

Serial No.: Group Art Unit:

Filed: Herewith Examiner:

For: Brake Pad Comprising a Retaining Spring Device

Attorney Docket No.: AP9673 Paper No.

Box PCT
Commissioner for Patents
Washington, D.C. 20231
Attn: EO/US

PRELIMINARY AMENDMENT

Dear Sir:

Please amend the application as follows prior to examination on the merits.

IN THE CLAIMS

Please cancel claims 1-17 and add the following new claims.

CERTIFICATE OF MAILING/TRANSMISSION (37 CFR 1.8(a))

I hereby certify that this correspondence is, on the date shown below, being:

☑ deposited with the United States Postal Service with sufficient postage as Express Mail, Post Office to Addressee, Mailing Label No.: EL 781 401 411 US, addressed to Box PCT, Commissioner for Patents, Washington, DC 20231

Date: 8/16/01

☐ transmitted by facsimile to the Patent and Trademark Office. to Examiner _____ at _____

Joyce Krumpe
Signature

Joyce Krumpe

18. (New) Brake pad assembly, comprising:

a retaining spring device coupled to said brake pad, said spring device for detachably coupling the brake pad to a piston of a spot-type disc brake said retaining spring device including at least one spring element which includes, at least one portion, under spring bias and wherein said at least one spring element is movable into abutment in a groove in the piston and is attached to the side of the brake pad by means of at least one retaining element, wherein the retaining element is configured as a retaining plate which is undetachably fastened to the brake pad and has at least one integrated retaining member.

19. (New) The brake pad as claimed in claim 18, wherein the brake pad includes a carrier plate and a friction lining applied thereto, wherein the retaining element is being undetachably connected to the carrier plate.

20. (New) The brake pad as claimed in claim 18, further including a spring element which, with at least two portions thereof under spring bias, is movable into abutment in the groove in the piston.

21. (New) The brake pad of claim 20, wherein the spring element includes at least one first spring portion which urges the brake pad against the piston.

22. (New) The brake pad of claim 21, wherein the spring element includes two first spring portions which are arranged opposite each other with respect to an axis of said piston axis.

23. (New) The brake pad of claim 22, wherein the spring element includes at least one second spring portion which applies a spring force to the brake pad generally perpendicularly to the piston axis.

24. (New) The brake pad of claim 18, further includes several spring elements which, under spring bias, are respectively associated abuttable with exactly one portion in the groove in the piston.

25. (New) The brake pad of claim 18, further including two first spring elements, wherein each one of said two first spring elements includes one first spring portion for urging the brake pad against the piston.

26. (New) The brake pad of claim 25, wherein the two first spring elements are arranged opposite each other with respect to the piston axis.

27. (New) The brake pad of claim 24, further including at least one second spring element with a second spring portion which applies a spring force to the brake pad vertically to a piston axis.

28. (New) The brake pad of claim 22, wherein the spring element is configured as a sheet-metal spring or a wire spring.

29. (New) The brake pad of claim 18, wherein the retaining member is configured as a hook or eyelet.

30. (New) The brake pad of claim 18, wherein the retaining plate is configured as a damping plate.

REMARKS

Prior to a formal examination of the above-identified application, acceptance of the new claims and the enclosed substitute specification (under 37 CFR 1.125) is respectfully requested. It is believed that the substitute specification and new claims will facilitate processing of the application in accordance with M.P.E.P. 608.01(q). The substitute

specification and new claims are in compliance with 37 CFR 1.52 (a and b) and, while making no substantive changes, are submitted to conform this case to the formal requirements and long-established formal standards of U.S. Patent Office practice, and to provide improved idiom and better grammatical form.

The enclosed substitute specification is presented herein in both marked-up and clean versions.

STATEMENT

The undersigned, an attorney registered to practice before the office, hereby states that the enclosed substitute specification includes the same changes as are indicated in the mark-up copy of the original specification. The substitute specification contains no new subject matter.

Respectfully submitted,

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R0121638.DOC

SUBSTITUTE SPECIFICATION: CLEAN COPY

AP9673

Brake Pad Comprising a Retaining Spring Device

Technical Field

[0001] The present invention generally relates to vehicle brake and more particularly relates to a brake pad comprising a retaining spring device for the detachable mounting support of a brake pad on a piston of a spot-type disc brake and for clamping engagement of the brake pad in relation to the spot-type disc brake.

Background of The Invention

[0002] DE 197 05 803 A1 e.g. discloses a spring element which is not only used to fix the carrier plate of the brake pad in position on the piston but, additionally, to ensure a permanently acting bias between the components concerned (brake caliper, brake carrier, brake pads) so that rattle noises can be suppressed effectively when the brake is not applied. To this end, the prior-art spring element, with a central part having the configuration of a divided circle, is locked into the groove of the piston and includes two arms which are shaped in a mirror-inverted manner. The arms extend from the central part until the radially outward hammerhead-shaped ends of the carrier plate and, close to the end, each have an axially outwards and downwards deflected part. The shaping and the spring force of these spring arms are conformed to one another so that the carrier plate is urged axially against the end surface of the piston and radially against a brake carrier. Due to the fact that the two downwards bent-off parts of the arms achieve that the prior arm spring element makes catch at both ends of the carrier plate and at least in part extend over both ends of the carrier plate, the provision of a special spring element adapted to the configuration of the respective carrier plate is required. This has limiting effects on the possible adjustments of the bias.

[0003] DE 12 23 633 A1 describes another spring element which has angled-off ends that snap into recesses in the carrier plate to achieve the resilient connection between the carrier

plate and the brake piston. Unfavorably, this also causes the necessity to adapt the spring element to the exact geometry of the carrier plate which limits the range of application and, more particularly, does not permit adjusting the bias of the spring element in a simple fashion.

[0004] A pad retaining spring is also disclosed in DE 196 01 435 A1 which is connected to the friction lining by means of a base portion and to the brake piston by means of at least one resilient portion. The base portion bears at least in areas against the side of the carrier plate remote from the friction lining, extends between the carrier plate and the brake piston and engages with the resilient portion into a groove on the front surface of the brake piston. The resilient portions may only be configured to be very short so that their spring characteristics also permits only little variation. The result is that this assembly is susceptible to tolerances.

[0005] In view of the above, an object of the present invention is to improve upon a brake pad comprising a retaining spring device in such a fashion as to overcome the disadvantages of the state of the art, especially by providing a solution with a short overall length which ensures a safe attachment of the brake pad to the piston and permits employment in different brake pad designs and different types of contruction of spot-type disc brakes.

[0006] This object is achieved according to the present invention because a brake pad for the detachable attachment to a piston of a spot-type disc brake comprises a retaining spring device with at least one spring element which is provided for engagement into a groove of the piston and is secured to the brake pad by means of a retaining element. Preferably, the brake pad comprises a carrier plate and a friction lining fitted thereto, and the retaining element is especially undetachably connected to the carrier plate.

[0007] In a first embodiment of the present invention, the retaining spring device comprises only one single spring element which, with at least two spring portions, abuts under spring bias in the groove in the piston or, respectively, is locked in the groove. This permits applying different spring forces to the brake pad, depending on the number of spring portions arranged in the groove. Apart from an axial retaining force which retains the brake pad in abutment on

the piston, an additional force component can be applied in a radial direction to the brake pad due to the spring element. This force component in a radial direction, with respect to the brake disc axis, is used to clamp the brake pads, a brake caliper and, as the case may be, a brake carrier with respect to each other in order to suppress undesirable rattle noise. Thus, the retaining spring device fulfils a suitable double function. It can be provided that the spring element has a closed shape. In this case, the spring element can preferably be bent from a wire ring.

[0008] As an alternative, it is disclosed in the present invention that the spring element has an open design and includes several spring portions, which are especially separated from one another, which abut in the piston groove and apply differently directed force components to the brake pad. As a whole, the number of components needed can be minimized favorably by the described variations with only one single spring element.

[0009] According to a preferred aspect of the present invention, several spring elements, preferably two or three, are provided which each abut under spring bias in the piston groove. The individual spring elements can have a simpler and thus less costly design by the use of several spring elements. Further, the different functions of the retaining spring device can be split up among the individual spring elements. This permits the well-defined rating and configuration of the spring elements. In this arrangement, two first spring elements which are arranged preferably opposite each other with respect to the piston axis serve for the axial attachment of the brake pad on the piston. Another second spring element applies a spring force to the brake pad vertically to the abutment surface between the brake pad and the piston and, hence, is used for the radial clamping engagement of the brake pad, brake caliper and, as the case may be, brake carrier.

[0010] Preferably, the spring element or the spring elements is/are designed as wire spring or sheet-metal spring. This permits a particularly simple manufacture.

[0011] Also, it is proposed by the present invention that the retaining element is configured as a retaining member integrated in the brake pad or the carrier plate. The bias of the spring element which acts upon the brake pad can be influenced specifically by way of the design of at least one retaining member or any other point of abutment of the spring element on the brake pad. In addition, retaining members of this type can also be formed on a retaining plate that is undetachably connected to the brake pad or the carrier plate. A favorable design of the retaining members is their configuration as eyelets or hooks in which the spring element can be attached easily.

[0012] In a preferred aspect of the present invention, the retaining spring device is combined with a conventional damping arrangement on the brake pad for noise suppression. To this end, the retaining plate which is undetachably connected to the brake pad and on which at least one spring element is fastened is designed as a damping plate or any other damping layer.

[0013] Also, the retaining elements for the spring element can be designed as locking washers. These axial locking washers are preferably fastened on a projection of the brake pad and extend over the spring element for the mounting support. It is preferred that such projections are formed as a punched-through projection or similar elevation on the carrier plate or on the retaining plate.

[0014] Special embodiments of the present invention are characterized by that the retaining elements are at least partly inserted into the brake pad or the carrier plate, preferably as an inserted retaining pin or rivet, the said retaining pin or the rivet axially overlapping the spring element and thereby fastening it to the brake pad.

[0015] The retaining spring device described is especially suitable due to its functionality and further necessitates only a small axial mounting space. This permits universal application of the retaining spring device of the present invention with different brake pad designs and in

different types of construction of spot-type disc brakes, for example, fist-type caliper brakes, fixed-type caliper brakes, electromechanic brakes, combined service and parking brakes, etc.

Brief Description of The Drawings

[0016] Figure 1 is a partly cross-sectional side view of a brake pad comprising a retaining spring device in the condition of installation in a spot-type disc brake.

[0017] Figures 2a-c show three views of a brake pad comprising a retaining spring device in a similar design to Figure 1.

[0018] Figures 3a-b show two views of a brake pad comprising a retaining spring device in a second design with a one-part spring element.

[0019] Figures 4-5 are two cross-sectional partial views of further variations for the alternative fixation of the spring element on the brake pad according to the present invention.

Detailed Description of The Preferred Embodiments

[0020] The brake pad 1 comprising a retaining spring device 7 shown in Figure 1 is illustrated in its installation position inside a spot-type disc brake configured as a fist-type caliper brake 6. The fist-type caliper brake 6 basically comprises a brake caliper 8 which straddles a brake disc (not shown) and brake pads 1 arranged on either side of the brake disc, and a brake carrier 9 mounted fast with the vehicle. The brake caliper 8 with respect to a brake disc axis (not shown) is axially slidably mounted on the brake carrier 9. The brake pads 1 which are arranged on either side of the brake disc are accommodated in the brake carrier 9 so as to be slidable in an axial direction for the purpose of transmitting brake circumferential forces by way of lateral attachments 10. To actuate the fist-type caliper brake 6, i.e., to press the brake pads 1 against the brake disc, there is provision of an actuating unit with a piston 5, and the said actuating unit is preferably operable hydraulically, mechanically, or

electromechanically. For the fist-type caliper brake 6 shown, a first brake pad 1 is moved into abutment with the brake disc directly by displacement of the piston 5, and a second brake lining is moved into abutment with the brake disc indirectly by oppositely directed axial displacement of the brake caliper 8. The brake circumferential forces which occur on the brake pads 1 are introduced directly into the brake carrier 9 formed fast with the vehicle by way of the lateral attachments 10.

[0021] The first piston-side brake pad 1 is coupled to the movement of the piston 5 by means of a retaining spring device 7. This retaining spring device 7 essentially comprises two first spring elements 14, 14' and a second spring element 15. The spring elements 14, 14', 15 are locked in a groove 11 of the piston 5 and fastened to the brake pad 1, on the other hand. Further details of the retaining spring device can be gathered from Figures 2a-c.

[0022] Figures 2a-c show a piston-side brake pad 1 which comprises a carrier plate 2 and a friction lining 3 fitted thereto. The friction lining 3 is intended for abutment on the brake disc (not shown). A retaining plate 12 is attached, preferably undetachably, e.g. by cementing, on the side of the carrier plate 2 remote from the friction lining 3. In turn, the spring elements 14, 14', 15 are fixed to the retaining plate 12 by means of several retaining members 13. The individual retaining members 13 are in particular designed as hooks or eyelets which respectively embrace the spring elements 14, 14', 15. With first 16 or second 17 spring portions, the spring elements 14, 14', 15 are arranged under bias in a groove 11 on the piston 5, thereby retaining the brake pad 1 axially on the piston 5.

[0023] In an especially favorable manner, the spring elements 14, 14', 15 are bent from simple spring wire portions and can be configured open and in the shape of a closed wire ring. In addition, designs of the spring elements 14, 14', 15 made of spring plate are principally also possible.

[0024] The two first spring elements 14, 14' are arranged opposite each other with respect to the piston axis 18. With first spring portions 16 respectively they are locked in the piston

groove 11 and apply an axial spring force to the brake pad 1. The brake pad 1 is thereby pressed against the piston 5 and coupled to the piston movement during the brake actuation.

[0025] The second spring element 15 acts by means of a second spring portion 17 on the brake pad 1 by way of a force component directed vertically (generally perpendicularly) to the piston axis 18. This clamps the brake pad 1 radially with the brake caliper 8 and, thus, also with the brake carrier 9 by way of the piston 5. A rattle-free abutment of the brake pad 1 on the brake carrier 9 is thereby ensured.

[0026] The employment of several spring elements 14, 14', 15 permits a separation of functions within the retaining spring device into 'axial pad mounting support on the piston' and 'rattle-free radial clamping engagement of brake pad, brake caliper, and brake carrier'. Further, this permits the rating and configuration of the individual spring elements, as the purpose may be.

[0027] Figures 3a and 3b show two views of a piston-side brake pad 1 comprising an alternative retaining spring device 7 for the detachable attachment on the piston. The one-part spring element 4 made of spring wire has a mirror-inverted design and comprises three spring portions 4b, 4d, 4f which are respectively locked by spring bias in a groove 11 that extends on the outside surface of the piston. The two first spring portions 4b and 4f ensure the axial attachment of the brake pad 1 on the piston, as described hereinabove. The second spring portion 4d acts radially upon the brake pad, i.e., vertically in Figures 3a and 3b. Two generally U-shaped portions 4c, 4e are designed between these three spring portions 4b, 4d, 4f and pressed against the carrier plate 2 of the brake pad 1 by way of retaining members 13b, 13c. Spring element 4 still further comprises two free end portions 4a, 4g which extend vertically to the piston axis away from the mirror-inverted first spring portions 4b, 4f and are pressed against the brake pad 1 by means of an eyelet-type retaining member 13a, 13d. On the side of the carrier plate 2 remote from the friction lining 3, a retaining plate 12 is fastened on which the retaining members 13a-d are shaped. Thus, the spring element 4 is retained on the brake pad 1 by way of the retaining plate 12. Preferably, the retaining plate 12 is designed as a

damping plate which is varnished, rubberized or coated in another fashion. The result is that one single component takes care of the mounting support of the spring element 4 and the damping function. This damping function is, however, not absolutely necessary for the present invention so that the retaining plate 12 may e.g. be designed as a conventional sheet-metal component part.

[0028] The axial connection between the brake pad 1 and the piston 5 is a catch-type connection, i.e., by way of the piston groove 11, or a compression joint, i.e., by way of the retaining members 13a to 13d. The radial spring action is generally adjusted by way of the shape and the compression of the U-shaped spring portions 4c, 4e and the end portions 4a, 4g.

[0029] In general, the retaining members can have a most differing configuration, for example, the shape of a hook, see 13b, 13c, or an eyelet, see 13a, 13d, according to Figures 3a and 3b. In addition, it is possible either to shape the respective retaining members 13, 13a-d on a retaining plate 12, or to integrate them directly in the brake pad 1 or the carrier plate 2.

[0030] Besides, the retaining elements can also be configured as separate component parts corresponding to Figures 4, 5 which are undetachably connected to the brake pad 1 or the carrier plate. According to Figure 3, the carrier plate 2 on its side remote from the friction lining 3 has a projection 19 in the form of a sheet-metal punched-through projection on which a separate locking washer 20 makes catch. Such a projection 19 can equally be provided on a retaining plate 12 connected to the brake pad 1. The locking washer 20 is clung on the projection 19 and, additionally, grips over a portion of the spring element 4 which is thereby retained on the brake pad 1.

[0031] According to the embodiment of Figure 5, a retaining pin or rivet 21 is fastened in the carrier plate 2 and also extends over the spring element 4 for the mounting support on the brake pad. The attachment of the spring element 4 by means of a locking washer 20 or a retaining pin or rivet 21 can be used particularly without an additional retaining plate. Also, it can be advantageous to configure the retaining members variably in order to permit a

variation of the spring bias. A variation of the spring bias can further be achieved by a corresponding shaping of the abutment surfaces of the spring element 4 on the retaining plate 12 or directly on the carrier plate 2. For example, punched-through projections or other elevations or depressions can be provided on the retaining plate 12 or on the carrier plate 2 for the spring element 4 to bear against. Thus, the desired bias for the spring element 4 can be achieved almost in all directions by suitably configuring the abutment surfaces of the spring element 4 on the retaining plate 12 or on the carrier plate 2.

[0032] In general, the retaining spring device 7 makes particularly versatile designs possible by the use of spring elements 4, 14, 14', 15 and retaining elements 12, 13, 20, 21. This permits the universal application of the retaining spring device in different brake pad constructions and different types of spot-type disc brakes.

AP9673

Brake Pad Comprising a Retaining Spring Device

Abstract of The Disclosure

[0033] The present invention relates to a brake pad having a retaining spring device for the detachable attachment of the brake pad on a piston of a spot-type disc brake. The retaining spring device includes at least one spring element which, with at least one spring portion, is engaged under spring bias into a circumferential groove on the outside surface of the piston. The spring element is attached to the side of the brake pad close to the piston by means of at least one retaining element. The retaining spring device permits the application of different spring force components due to the use of spring elements and retaining elements and, in addition, can be applied universally in different brake pad configurations.

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SUBSTITUTE SPECIFICATION: MARKED UP COPY

AP9673

[PC 9673]

Brake Pad Comprising a Retaining Spring Device

Technical Field

The present invention generally relates to vehicle brake and more particularly relates to a brake pad comprising a retaining spring device for the detachable mounting support of a brake pad on a piston of a spot-type disc brake and for clamping engagement of the brake pad in relation to the spot-type disc brake.

Background of The Invention

DE 197 05 803 A1 e.g. discloses a spring element which is not only used to fix the carrier plate of the brake pad in position on the piston but, additionally, to ensure a permanently acting bias between the components concerned (brake caliper, brake carrier, brake pads) so that rattle noises can be suppressed effectively when the brake is not applied. To this end, the prior-art spring element, with a central part having the configuration of a divided circle, is locked into the groove of the piston and includes two arms which are shaped in a mirror-inverted manner. The arms extend from the central part until the radially outward hammerhead-shaped ends of the carrier plate and, close to the end, each have an axially outwards and downwards deflected part. The shaping and the spring force of these spring arms are conformed to one another so that the carrier plate is urged axially against the end surface of the piston and radially against a brake carrier. Due to the fact that the two downwards bent-off parts of the arms achieve that the prior arm spring element makes catch at both ends of the carrier plate and at least in part extend over both ends of the carrier plate, the provision of a special spring element adapted to the configuration of the respective carrier plate is required. This has limiting effects on the possible adjustments of the bias.

DE 12 23 633 A1 describes another spring element which has angled-off ends that snap into recesses in the carrier plate to achieve the resilient connection between the carrier plate and the brake piston. Unfavorably, this also causes the necessity to adapt the spring element to the exact geometry of the carrier plate which limits the range of application and, more particularly, does not permit adjusting the bias of the spring element in a simple fashion.

A pad retaining spring is also disclosed in DE 196 01 435 A1 which is connected to the friction lining by means of a base portion and to the brake piston by means of at least one resilient portion. The base portion bears at least in areas against the side of the carrier plate remote from the friction lining, extends between the carrier plate and the brake piston and engages with the resilient portion into a groove on the front surface of the brake piston. The resilient portions may only be configured to be very short so that their spring characteristics also permits only little variation. The result is that this assembly is susceptible to tolerances.

In view of the above, an object of the present invention is to improve upon a brake pad comprising a retaining spring device in such a fashion as to overcome the disadvantages of the state of the art, especially by providing a solution with a short overall length which ensures a safe attachment of the brake pad to the piston and permits employment in different brake pad designs and different types of contruction of spot-type disc brakes.

This object is achieved according to the present invention because a brake pad for the detachable attachment to a piston of a spot-type disc brake comprises a retaining spring device with at least one spring element which is provided for engagement into a groove of the piston and is secured to the brake pad by means of a retaining element. Preferably, the brake pad comprises a carrier plate and a friction lining fitted thereto, and the retaining element is especially undetachably connected to the carrier plate.

In a first embodiment of the present invention, the retaining spring device comprises only one single spring element which, with at least two spring portions, abuts under spring bias in the groove in the piston or, respectively, is locked in the groove. This permits applying different

spring forces to the brake pad, depending on the number of spring portions arranged in the groove. Apart from an axial retaining force which retains the brake pad in abutment on the piston, an additional force component can be applied in a radial direction to the brake pad due to the spring element. This force component in a radial direction, with respect to the brake disc axis, is used to clamp the brake pads, a brake caliper and, as the case may be, a brake carrier with respect to each other in order to suppress undesirable rattle noise. Thus, the retaining spring device fulfils a suitable double function. It can be provided that the spring element has a closed shape. In this case, the spring element can preferably be bent from a wire ring.

As an alternative, it is disclosed in the present invention that the spring element has an open design and includes several spring portions, which are especially separated from one another, which abut in the piston groove and apply differently directed force components to the brake pad. As a whole, the number of components needed can be minimized favorably by the described variations with only one single spring element.

According to a preferred aspect of the present invention, several spring elements, preferably two or three, are provided which each abut under spring bias in the piston groove. The individual spring elements can have a simpler and thus less costly design by the use of several spring elements. Further, the different functions of the retaining spring device can be split up among the individual spring elements. This permits the well-defined rating and configuration of the spring elements. In this arrangement, two first spring elements which are arranged preferably opposite each other with respect to the piston axis serve for the axial attachment of the brake pad on the piston. Another second spring element applies a spring force to the brake pad vertically to the abutment surface between the brake pad and the piston and, hence, is used for the radial clamping engagement of the brake pad, brake caliper and, as the case may be, brake carrier.

Preferably, the spring element or the spring elements is/are designed as wire spring or sheet-metal spring. This permits a particularly simple manufacture.

Also, it is proposed by the present invention that the retaining element is configured as a retaining member integrated in the brake pad or the carrier plate. The bias of the spring element which acts upon the brake pad can be influenced specifically by way of the design of at least one retaining member or any other point of abutment of the spring element on the brake pad. In addition, retaining members of this type can also be formed on a retaining plate that is undetachably connected to the brake pad or the carrier plate. A favorable design of the retaining members is their configuration as eyelets or hooks in which the spring element can be attached easily.

In a preferred aspect of the present invention, the retaining spring device is combined with a conventional damping arrangement on the brake pad for noise suppression. To this end, the retaining plate which is undetachably connected to the brake pad and on which at least one spring element is fastened is designed as a damping plate or any other damping layer.

Also, the retaining elements for the spring element can be designed as locking washers. These axial locking washers are preferably fastened on a projection of the brake pad and extend over the spring element for the mounting support. It is preferred that such projections are formed as a punched-through projection or similar elevation on the carrier plate or on the retaining plate.

Special embodiments of the present invention are characterized by that the retaining elements are at least partly inserted into the brake pad or the carrier plate, preferably as an inserted retaining pin or rivet, the said retaining pin or the rivet axially overlapping the spring element and thereby fastening it to the brake pad.

The retaining spring device described is especially suitable due to its functionality and further necessitates only a small axial mounting space. This permits universal application of the retaining spring device of the present invention with different brake pad designs and in

different types of construction of spot-type disc brakes, for example, fist-type caliper brakes, fixed-type caliper brakes, electromechanic brakes, combined service and parking brakes, etc.

[Further features and advantages of the present invention can be taken from the subclaims and the following description wherein the embodiments of this invention are explained in detail by making reference to the accompanying schematic drawings. In the drawings,]

Brief Description of The Drawings

Figure 1 is a partly cross-sectional side view of a brake pad comprising a retaining spring device in the condition of installation in a spot-type disc brake.

Figures 2a-c show three views of a brake pad comprising a retaining spring device in a similar design to Figure 1.

Figures 3a-b show two views of a brake pad comprising a retaining spring device in a second design with a one-part spring element.

Figures 4-5 are two cross-sectional partial views of further variations for the alternative fixation of the spring element on the brake pad according to the present invention.

Detailed Description of The Preferred Embodiments

The brake pad 1 comprising a retaining spring device 7 shown in Figure 1 is illustrated in its installation position inside a spot-type disc brake configured as a fist-type caliper brake 6. The fist-type caliper brake 6 basically comprises a brake caliper 8 which straddles a brake disc (not shown) and brake pads 1 arranged on either side of the brake disc, and a brake carrier 9 mounted fast with the vehicle. The brake caliper 8 with respect to a brake disc axis

(not shown) is axially slidably mounted on the brake carrier 9. The brake pads 1 which are arranged on either side of the brake disc are accommodated in the brake carrier 9 so as to be slidable in an axial direction for the purpose of transmitting brake circumferential forces by way of lateral attachments 10. To actuate the fist-type caliper brake 6, i.e., to press the brake pads 1 against the brake disc, there is provision of an actuating unit with a piston 5, and the said actuating unit is preferably operable hydraulically, mechanically, or electromechanically. For the fist-type caliper brake 6 shown, a first brake pad 1 is moved into abutment with the brake disc directly by displacement of the piston 5, and a second brake lining is moved into abutment with the brake disc indirectly by oppositely directed axial displacement of the brake caliper 8. The brake circumferential forces which occur on the brake pads 1 are introduced directly into the brake carrier 9 formed fast with the vehicle by way of the lateral attachments 10.

The first piston-side brake pad 1 is coupled to the movement of the piston 5 by means of a retaining spring device 7. This retaining spring device 7 essentially comprises two first spring elements 14, 14' and a second spring element 15. The spring elements 14, 14', 15 are locked in a groove 11 of the piston 5 and fastened to the brake pad 1, on the other hand. Further details of the retaining spring device can be gathered from Figures 2a-c.

Figures 2a-c show a piston-side brake pad 1 which comprises a carrier plate 2 and a friction lining 3 fitted thereto. The friction lining 3 is intended for abutment on the brake disc (not shown). A retaining plate 12 is attached, preferably undetachably, e.g. by cementing, on the side of the carrier plate 2 remote from the friction lining 3. In turn, the spring elements 14, 14', 15 are fixed to the retaining plate 12 by means of several retaining members 13. The individual retaining members 13 are in particular designed as hooks or eyelets which respectively embrace the spring elements 14, 14', 15. With first 16 or second 17 spring portions, the spring elements 14, 14', 15 are arranged under bias in a groove 11 on the piston 5, thereby retaining the brake pad 1 axially on the piston 5.

In an especially favorable manner, the spring elements 14, 14', 15 are bent from simple spring wire portions and can be configured open and in the shape of a closed wire ring. In addition, designs of the spring elements 14, 14', 15 made of spring plate are principally also possible.

The two first spring elements 14, 14' are arranged opposite each other with respect to the piston axis 18. With first spring portions 16 respectively they are locked in the piston groove 11 and apply an axial spring force to the brake pad 1. The brake pad 1 is thereby pressed against the piston 5 and coupled to the piston movement during the brake actuation.

The second spring element 15 acts by means of a second spring portion 17 on the brake pad 1 by way of a force component directed vertically (generally perpendicularly) to the piston axis 18. This clamps the brake pad 1 radially with the brake caliper 8 and, thus, also with the brake carrier 9 by way of the piston 5. A rattle-free abutment of the brake pad 1 on the brake carrier 9 is thereby ensured.

The employment of several spring elements 14, 14', 15 permits a separation of functions within the retaining spring device into 'axial pad mounting support on the piston' and 'rattle-free radial clamping engagement of brake pad, brake caliper, and brake carrier'. Further, this permits the rating and configuration of the individual spring elements, as the purpose may be.

Figures 3a and 3b show two views of a piston-side brake pad 1 comprising an alternative retaining spring device 7 for the detachable attachment on the piston. The one-part spring element 4 made of spring wire has a mirror-inverted design and comprises three spring portions 4b, 4d, 4f which are respectively locked by spring bias in a groove 11 that extends on the outside surface of the piston. The two first spring portions 4b and 4f ensure the axial attachment of the brake pad 1 on the piston, as described hereinabove. The second spring portion 4d acts radially upon the brake pad, i.e., vertically in Figures 3a and 3b. Two generally U-shaped portions 4c, 4e are designed between these three spring portions 4b, 4d, 4f and pressed against the carrier plate 2 of the brake pad 1 by way of retaining members 13b, 13c. Spring element 4 still further comprises two free end portions 4a, 4g which extend

vertically to the piston axis away from the mirror-inverted first spring portions 4b, 4f and are pressed against the brake pad 1 by means of an eyelet-type retaining member 13a, 13d. On the side of the carrier plate 2 remote from the friction lining 3, a retaining plate 12 is fastened on which the retaining members 13a-d are shaped. Thus, the spring element 4 is retained on the brake pad 1 by way of the retaining plate 12. Preferably, the retaining plate 12 is designed as a damping plate which is varnished, rubberized or coated in another fashion. The result is that one single component takes care of the mounting support of the spring element 4 and the damping function. This damping function is, however, not absolutely necessary for the present invention so that the retaining plate 12 may e.g. be designed as a conventional sheet-metal component part.

The axial connection between the brake pad 1 and the piston 5 is a catch-type connection, i.e., by way of the piston groove 11, or a compression joint, i.e., by way of the retaining members 13a to 13d. The radial spring action is generally adjusted by way of the shape and the compression of the U-shaped spring portions 4c, 4e and the end portions 4a, 4g.

In general, the retaining members can have a most differing configuration, for example, the shape of a hook, see 13b, 13c, or an eyelet, see 13a, 13d, according to Figures 3a and 3b. In addition, it is possible either to shape the respective retaining members 13, 13a-d on a retaining plate 12, or to integrate them directly in the brake pad 1 or the carrier plate 2.

Besides, the retaining elements can also be configured as separate component parts corresponding to Figures 4, 5 which are undetachably connected to the brake pad 1 or the carrier plate. According to Figure 3, the carrier plate 2 on its side remote from the friction lining 3 has a projection 19 in the form of a sheet-metal punched-through projection on which a separate locking washer 20 makes catch. Such a projection 19 can equally be provided on a retaining plate 12 connected to the brake pad 1. The locking washer 20 is clung on the projection 19 and, additionally, grips over a portion of the spring element 4 which is thereby retained on the brake pad 1.

According to the embodiment of Figure 5, a retaining pin or rivet 21 is fastened in the carrier plate 2 and also extends over the spring element 4 for the mounting support on the brake pad. The attachment of the spring element 4 by means of a locking washer 20 or a retaining pin or rivet 21 can be used particularly without an additional retaining plate. Also, it can be advantageous to configure the retaining members variably in order to permit a variation of the spring bias. A variation of the spring bias can further be achieved by a corresponding shaping of the abutment surfaces of the spring element 4 on the retaining plate 12 or directly on the carrier plate 2. For example, punched-through projections or other elevations or depressions can be provided on the retaining plate 12 or on the carrier plate 2 for the spring element 4 to bear against. Thus, the desired bias for the spring element 4 can be achieved almost in all directions by suitably configuring the abutment surfaces of the spring element 4 on the retaining plate 12 or on the carrier plate 2.

In general, the retaining spring device 7 makes particularly versatile designs possible by the use of spring elements 4, 14, 14', 15 and retaining elements 12, 13, 20, 21. This permits the universal application of the retaining spring device in different brake pad constructions and different types of spot-type disc brakes.

AP9673

[Abstract:]

Brake Pad Comprising a Retaining Spring Device

Abstract of The Disclosure

The present invention relates to a brake pad [(1) comprising] having a retaining spring device [(7)] for the detachable attachment of the brake pad [(1)] on a piston [(5)] of a spot-type disc brake. The retaining spring device [(7) comprises] includes at least one spring element [(4, 14, 14', 15)] which, with at least one spring portion [(16, 17)], is engaged under spring bias into a circumferential groove [(11)] on the outside surface of the piston [(5)]. The spring element [(4, 14, 14', 15)] is attached to the side of the brake pad [(1)] close to the piston [(5)] by means of at least one retaining element [(12, 13)]. The retaining spring device [(7)] permits the application of different spring force components due to the use of spring elements [(4, 14, 14', 15)] and retaining elements [(12, 13)] and, in addition, can be applied universally in different brake pad configurations.

[(Figure 2a-b)]

Brake Pad Comprising a Retaining Spring Device

The present invention relates to a brake pad comprising a retaining spring device for the detachable mounting support of a brake pad on a piston of a spot-type disc brake and for clamping engagement of the brake pad in relation to the spot-type disc brake.

DE 197 05 803 A1 e.g. discloses a spring element which is not only used to fix the carrier plate of the brake pad in position on the piston but, additionally, to ensure a permanently acting bias between the components concerned (brake caliper, brake carrier, brake pads) so that rattle noises can be suppressed effectively when the brake is not applied. To this end, the prior-art spring element, with a central part having the configuration of a divided circle, is locked into the groove of the piston and includes two arms which are shaped in a mirror-inverted manner. The arms extend from the central part until the radially outward hammerhead-shaped ends of the carrier plate and, close to the end, each have an axially outwards and downwards deflected part. The shaping and the spring force of these spring arms are conformed to one another so that the carrier plate is urged axially against the end surface of the piston and radially against a brake carrier. Due to the fact that the two downwards bent-off parts of the arms achieve that the prior arm spring element makes catch at both ends of the carrier plate and at least in part extend over both ends of the carrier plate, the provision of a special spring element adapted to the configuration of the respective carrier plate is

required. This has limiting effects on the possible adjustments of the bias.

DE 12 23 633 A1 describes another spring element which has angled-off ends that snap into recesses in the carrier plate to achieve the resilient connection between the carrier plate and the brake piston. Unfavorably, this also causes the necessity to adapt the spring element to the exact geometry of the carrier plate which limits the range of application and, more particularly, does not permit adjusting the bias of the spring element in a simple fashion.

A pad retaining spring is also disclosed in DE 196 01 435 A1 which is connected to the friction lining by means of a base portion and to the brake piston by means of at least one resilient portion. The base portion bears at least in areas against the side of the carrier plate remote from the friction lining, extends between the carrier plate and the brake piston and engages with the resilient portion into a groove on the front surface of the brake piston. The resilient portions may only be configured to be very short so that their spring characteristics also permits only little variation. The result is that this assembly is susceptible to tolerances.

In view of the above, an object of the present invention is to improve upon a brake pad comprising a retaining spring device in such a fashion as to overcome the disadvantages of the state of the art, especially by providing a solution with a short overall length which ensures a safe attachment of the brake pad to the piston and permits employment in different brake pad designs and different types of contruction of spot-type disc brakes.

This object is achieved according to the present invention because a brake pad for the detachable attachment to a piston of a spot-type disc brake comprises a retaining spring device with at least one spring element which is provided for engagement into a groove of the piston and is secured to the brake pad by means of a retaining element. Preferably, the brake pad comprises a carrier plate and a friction lining fitted thereto, and the retaining element is especially undetachably connected to the carrier plate.

In a first embodiment of the present invention, the retaining spring device comprises only one single spring element which, with at least two spring portions, abuts under spring bias in the groove in the piston or, respectively, is locked in the groove. This permits applying different spring forces to the brake pad, depending on the number of spring portions arranged in the groove. Apart from an axial retaining force which retains the brake pad in abutment on the piston, an additional force component can be applied in a radial direction to the brake pad due to the spring element. This force component in a radial direction, with respect to the brake disc axis, is used to clamp the brake pads, a brake caliper and, as the case may be, a brake carrier with respect to each other in order to suppress undesirable rattle noise. Thus, the retaining spring device fulfils a suitable double function. It can be provided that the spring element has a closed shape. In this case, the spring element can preferably be bent from a wire ring.

As an alternative, it is disclosed in the present invention that the spring element has an open design and includes several spring portions, which are especially separated from one another, which abut in the piston groove and apply differently directed force components to the brake pad. As a whole, the

number of components needed can be minimized favorably by the described variations with only one single spring element.

According to a preferred aspect of the present invention, several spring elements, preferably two or three, are provided which each abut under spring bias in the piston groove. The individual spring elements can have a simpler and thus less costly design by the use of several spring elements. Further, the different functions of the retaining spring device can be split up among the individual spring elements. This permits the well-defined rating and configuration of the spring elements. In this arrangement, two first spring elements which are arranged preferably opposite each other with respect to the piston axis serve for the axial attachment of the brake pad on the piston. Another second spring element applies a spring force to the brake pad vertically to the abutment surface between the brake pad and the piston and, hence, is used for the radial clamping engagement of the brake pad, brake caliper and, as the case may be, brake carrier.

Preferably, the spring element or the spring elements is/are designed as wire spring or sheet-metal spring. This permits a particularly simple manufacture.

Also, it is proposed by the present invention that the retaining element is configured as a retaining member integrated in the brake pad or the carrier plate. The bias of the spring element which acts upon the brake pad can be influenced specifically by way of the design of at least one retaining member or any other point of abutment of the spring element on the brake pad. In addition, retaining members of this type can also be formed on a retaining plate that is undetachably connected to the brake pad or the carrier plate. A favorable design of the retaining members is their

configuration as eyelets or hooks in which the spring element can be attached easily.

In a preferred aspect of the present invention, the retaining spring device is combined with a conventional damping arrangement on the brake pad for noise suppression. To this end, the retaining plate which is undetachably connected to the brake pad and on which at least one spring element is fastened is designed as a damping plate or any other damping layer.

Also, the retaining elements for the spring element can be designed as locking washers. These axial locking washers are preferably fastened on a projection of the brake pad and extend over the spring element for the mounting support. It is preferred that such projections are formed as a punched-through projection or similar elevation on the carrier plate or on the retaining plate.

Special embodiments of the present invention are characterized by that the retaining elements are at least partly inserted into the brake pad or the carrier plate, preferably as an inserted retaining pin or rivet, the said retaining pin or the rivet axially overlapping the spring element and thereby fastening it to the brake pad.

The retaining spring device described is especially suitable due to its functionality and further necessitates only a small axial mounting space. This permits universal application of the retaining spring device of the present invention with different brake pad designs and in different types of construction of spot-type disc brakes, for example, fist-type caliper brakes, fixed-type caliper brakes, electromechanic brakes, combined service and parking brakes, etc.

Further features and advantages of the present invention can be taken from the subclaims and the following description wherein the embodiments of this invention are explained in detail by making reference to the accompanying schematic drawings. In the drawings,

Figure 1 is a partly cross-sectional side view of a brake pad comprising a retaining spring device in the condition of installation in a spot-type disc brake.

Figures 2a-c show three views of a brake pad comprising a retaining spring device in a similar design to Figure 1.

Figures 3a-b show two views of a brake pad comprising a retaining spring device in a second design with a one-part spring element.

Figures 4-5 are two cross-sectional partial views of further variations for the alternative fixation of the spring element on the brake pad according to the present invention.

The brake pad 1 comprising a retaining spring device 7 shown in Figure 1 is illustrated in its installation position inside a spot-type disc brake configured as a fist-type caliper brake 6. The fist-type caliper brake 6 basically comprises a brake caliper 8 which straddles a brake disc (not shown) and brake pads 1 arranged on either side of the brake disc, and a brake carrier 9 mounted fast with the vehicle. The brake caliper 8 with respect to a brake disc axis (not shown) is axially slidably mounted on the brake carrier 9. The brake pads 1 which are arranged on either side of the brake disc are accommodated

in the brake carrier 9 so as to be slidable in an axial direction for the purpose of transmitting brake circumferential forces by way of lateral attachments 10. To actuate the fist-type caliper brake 6, i.e., to press the brake pads 1 against the brake disc, there is provision of an actuating unit with a piston 5, and the said actuating unit is preferably operable hydraulically, mechanically, or electromechanically. For the fist-type caliper brake 6 shown, a first brake pad 1 is moved into abutment with the brake disc directly by displacement of the piston 5, and a second brake lining is moved into abutment with the brake disc indirectly by oppositely directed axial displacement of the brake caliper 8. The brake circumferential forces which occur on the brake pads 1 are introduced directly into the brake carrier 9 formed fast with the vehicle by way of the lateral attachments 10.

The first piston-side brake pad 1 is coupled to the movement of the piston 5 by means of a retaining spring device 7. This retaining spring device 7 essentially comprises two first spring elements 14, 14' and a second spring element 15. The spring elements 14, 14', 15 are locked in a groove 11 of the piston 5 and fastened to the brake pad 1, on the other hand. Further details of the retaining spring device can be gathered from Figures 2a-c.

Figures 2a-c show a piston-side brake pad 1 which comprises a carrier plate 2 and a friction lining 3 fitted thereto. The friction lining 3 is intended for abutment on the brake disc (not shown). A retaining plate 12 is attached, preferably undetachably, e.g. by cementing, on the side of the carrier plate 2 remote from the friction lining 3. In turn, the spring elements 14, 14', 15 are fixed to the retaining plate 12 by means of several retaining members 13. The individual retaining members 13 are in particular designed as hooks or eyelets which

respectively embrace the spring elements 14, 14', 15. With first 16 or second 17 spring portions, the spring elements 14, 14', 15 are arranged under bias in a groove 11 on the piston 5, thereby retaining the brake pad 1 axially on the piston 5.

In an especially favorable manner, the spring elements 14, 14', 15 are bent from simple spring wire portions and can be configured open and in the shape of a closed wire ring. In addition, designs of the spring elements 14, 14', 15 made of spring plate are principally also possible.

The two first spring elements 14, 14' are arranged opposite each other with respect to the piston axis 18. With first spring portions 16 respectively they are locked in the piston groove 11 and apply an axial spring force to the brake pad 1. The brake pad 1 is thereby pressed against the piston 5 and coupled to the piston movement during the brake actuation.

The second spring element 15 acts by means of a second spring portion 17 on the brake pad 1 by way of a force component directed vertically to the piston axis 18. This clamps the brake pad 1 radially with the brake caliper 8 and, thus, also with the brake carrier 9 by way of the piston 5. A rattle-free abutment of the brake pad 1 on the brake carrier 9 is thereby ensured.

The employment of several spring elements 14, 14', 15 permits a separation of functions within the retaining spring device into 'axial pad mounting support on the piston' and 'rattle-free radial clamping engagement of brake pad, brake caliper, and brake carrier'. Further, this permits the rating and configuration of the individual spring elements, as the purpose may be.

Figures 3a and 3b show two views of a piston-side brake pad 1 comprising an alternative retaining spring device 7 for the detachable attachment on the piston. The one-part spring element 4 made of spring wire has a mirror-inverted design and comprises three spring portions 4b, 4d, 4f which are respectively locked by spring bias in a groove 11 that extends on the outside surface of the piston. The two first spring portions 4b and 4f ensure the axial attachment of the brake pad 1 on the piston, as described hereinabove. The second spring portion 4d acts radially upon the brake pad, i.e., vertically in Figures 3a and 3b. Two generally U-shaped portions 4c, 4e are designed between these three spring portions 4b, 4d, 4f and pressed against the carrier plate 2 of the brake pad 1 by way of retaining members 13b, 13c. Spring element 4 still further comprises two free end portions 4a, 4g which extend vertically to the piston axis away from the mirror-inverted first spring portions 4b, 4f and are pressed against the brake pad 1 by means of an eyelet-type retaining member 13a, 13d. On the side of the carrier plate 2 remote from the friction lining 3, a retaining plate 12 is fastened on which the retaining members 13a-d are shaped. Thus, the spring element 4 is retained on the brake pad 1 by way of the retaining plate 12. Preferably, the retaining plate 12 is designed as a damping plate which is varnished, rubberized or coated in another fashion. The result is that one single component takes care of the mounting support of the spring element 4 and the damping function. This damping function is, however, not absolutely necessary for the present invention so that the retaining plate 12 may e.g. be designed as a conventional sheet-metal component part.

The axial connection between the brake pad 1 and the piston 5 is a catch-type connection, i.e., by way of the piston groove 11, or a compression joint, i.e., by way of the retaining members 13a to 13d. The radial spring action is generally

adjusted by way of the shape and the compression of the U-shaped spring portions 4c, 4e and the end portions 4a, 4g.

In general, the retaining members can have a most differing configuration, for example, the shape of a hook, see 13b, 13c, or an eyelet, see 13a, 13d, according to Figures 3a and 3b. In addition, it is possible either to shape the respective retaining members 13, 13a-d on a retaining plate 12, or to integrate them directly in the brake pad 1 or the carrier plate 2.

Besides, the retaining elements can also be configured as separate component parts corresponding to Figures 4, 5 which are undetachably connected to the brake pad 1 or the carrier plate. According to Figure 3, the carrier plate 2 on its side remote from the friction lining 3 has a projection 19 in the form of a sheet-metal punched-through projection on which a separate locking washer 20 makes catch. Such a projection 19 can equally be provided on a retaining plate 12 connected to the brake pad 1. The locking washer 20 is clung on the projection 19 and, additionally, grips over a portion of the spring element 4 which is thereby retained on the brake pad 1.

According to the embodiment of Figure 5, a retaining pin or rivet 21 is fastened in the carrier plate 2 and also extends over the spring element 4 for the mounting support on the brake pad. The attachment of the spring element 4 by means of a locking washer 20 or a retaining pin or rivet 21 can be used particularly without an additional retaining plate. Also, it can be advantageous to configure the retaining members variably in order to permit a variation of the spring bias. A variation of the spring bias can further be achieved by a corresponding shaping of the abutment surfaces of the spring element 4 on the retaining plate 12 or directly on the carrier plate 2. For

example, punched-through projections or other elevations or depressions can be provided on the retaining plate 12 or on the carrier plate 2 for the spring element 4 to bear against. Thus, the desired bias for the spring element 4 can be achieved almost in all directions by suitably configuring the abutment surfaces of the spring element 4 on the retaining plate 12 or on the carrier plate 2.

In general, the retaining spring device 7 makes particularly versatile designs possible by the use of spring elements 4, 14, 14', 15 and retaining elements 12, 13, 20, 21. This permits the universal application of the retaining spring device in different brake pad constructions and different types of spot-type disc brakes.

Patent Claims:

1. Brake pad (1) comprising a retaining spring device (7) for the detachable attachment of the brake pad (1) on a piston (5) of a spot-type disc brake (6) which comprises at least one spring element (4, 14, 14', 15),
c h a r a c t e r i z e d in that the spring element (4, 14, 14', 15) with at least one portion (4b, 4d, 4f, 16, 17) abuts under spring bias in a groove (11) in the piston (5) and is attached to the side of the brake pad (1) close to the piston (5) by means of at least one retaining element (12, 13, 13a-d, 20, 21) connected to the brake pad (1).

2. Brake pad comprising a retaining spring device as claimed in claim 1,
c h a r a c t e r i z e d in that the brake pad (1) includes a carrier plate (2) and a friction lining (3) applied thereto, the said retaining element (12, 13, 13a-d, 20, 21) being undetachably connected to the carrier plate (2).

3. Brake pad comprising a retaining spring device as claimed in any one of claims 1 to 2,
c h a r a c t e r i z e d in that there is provision of a spring element (4) which, with at least two portions (4b, 4d, 4f), abuts under spring bias in the groove (11) in the piston (5).

4. Brake pad comprising a retaining spring device as claimed in claim 3,
c h a r a c t e r i z e d in that the spring element (4) includes at least one first spring portion (4b, 4f) which urges the brake pad (1) against the piston (5).

5. Brake pad comprising a retaining spring device as claimed in claim 4,
c h a r a c t e r i z e d in that the spring element (4) includes two first spring portions (4b, 4f) which are arranged opposite each other with respect to the piston axis (18).

6. Brake pad comprising a retaining spring device as claimed in any one of claims 3 to 5,
c h a r a c t e r i z e d in that the spring element (4) includes at least one second spring portion (4d) which applies a spring force to the brake pad (1) vertically to the piston axis (18).

7. Brake pad comprising a retaining spring device as claimed in any one of claims 1 to 2,
c h a r a c t e r i z e d in that there is provision of several spring elements (14, 14', 15) which respectively abut with exactly one portion (16, 17) under spring bias in the groove (11) in the piston (5).

8. Brake pad comprising a retaining spring device as claimed in claim 7,
c h a r a c t e r i z e d in that there is provision of two first spring elements (14, 14') with respectively one first spring portion (16) which urge the brake pad (1) against the piston (5).

9. Brake pad comprising a retaining spring device as claimed in claim 8,
c h a r a c t e r i z e d in that the two first spring elements (14, 14') are arranged opposite each other with respect to the piston axis (18).

10. Brake pad comprising a retaining spring device as claimed in any one of claims 7 to 9,
c h a r a c t e r i z e d in that there is provision of at least one second spring element (15) with a second spring portion (17) which applies a spring force to the brake pad (1) vertically to a piston axis (18).

11. Brake pad comprising a retaining spring device as claimed in any one of the preceding claims,
c h a r a c t e r i z e d in that the spring element (4, 14, 14', 15) is respectively configured as a sheet-metal spring or a wire spring.

12. Brake pad comprising a retaining spring device as claimed in any one of the preceding claims,
c h a r a c t e r i z e d in that the retaining element is configured as a retaining member (13, 13a-d) integrated in the brake pad.

13. Brake pad comprising a retaining spring device as claimed in any one of claims 1 to 11,
c h a r a c t e r i z e d in that the retaining element is configured as a retaining plate (12) which is undetachably fastened to the brake pad (1) and has at least one integrated retaining member (13, 13a-d).

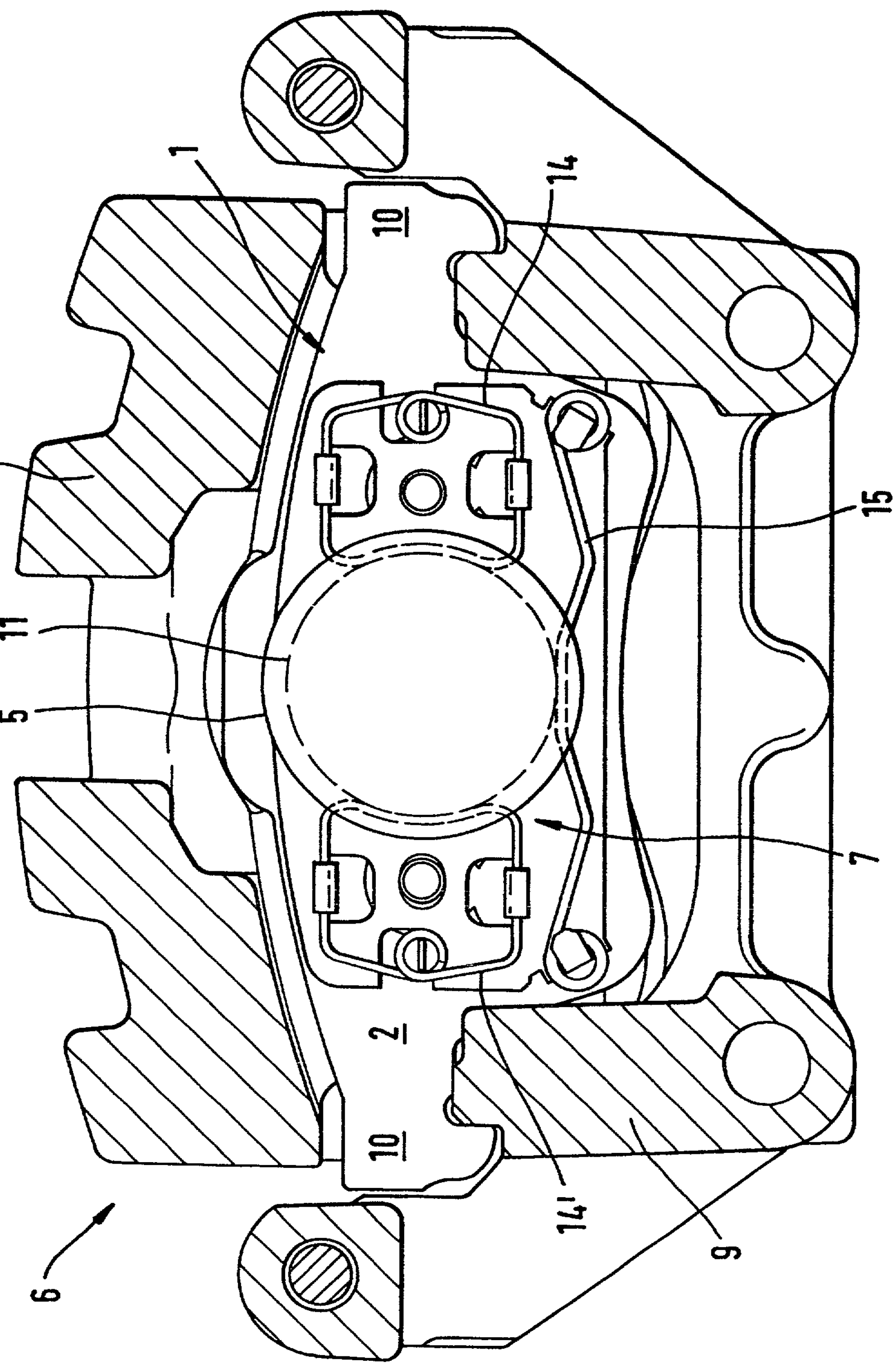
14. Brake pad comprising a retaining spring device as claimed in claim 11 or claim 12, c h a r a c t e r i z e d in that the retaining member (13, 13a-d) is configured as a hook or eyelet.

15. Brake pad comprising a retaining spring device as claimed in claim 13 or claim 14, c h a r a c t e r i z e d in that the retaining plate (12) is configured as a damping plate.

16. Brake pad comprising a retaining spring device as claimed in any one of claims 1 to 11, c h a r a c t e r i z e d in that the retaining element is configured as a locking washer (20) which is fastened to a projection (19) of the brake pad (1) and extends over at least one spring element (4, 14, 14′, 15).

17. Brake pad comprising a retaining spring device as claimed in any one of claims 1 to 11, c h a r a c t e r i z e d in that the retaining element is configured as a retaining pin or rivet (21) that is inserted into the brake pad and extends over at least one spring element (4, 14, 14′, 15).

Fig. 1



09/913635

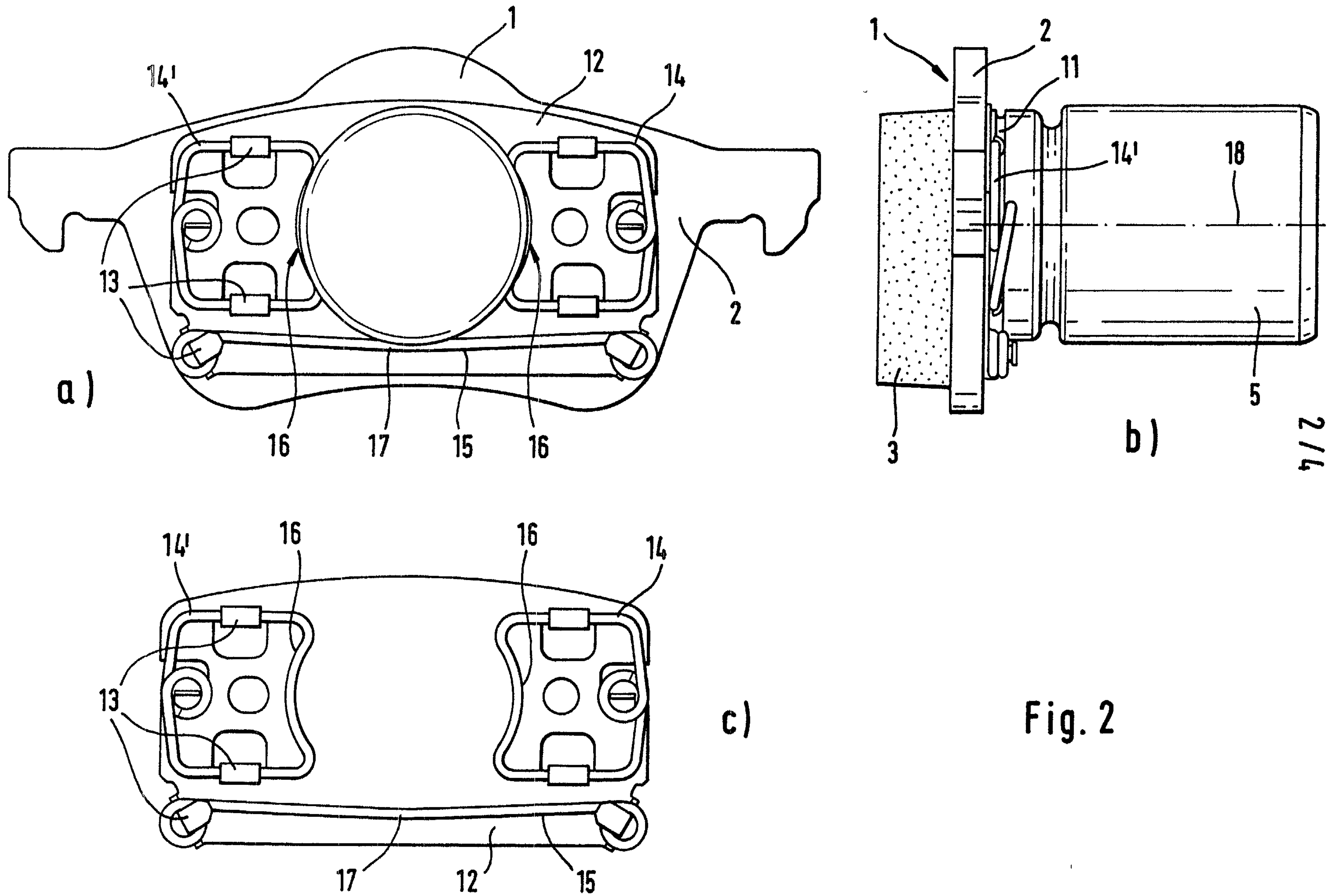


Fig. 2

Fig. 3a

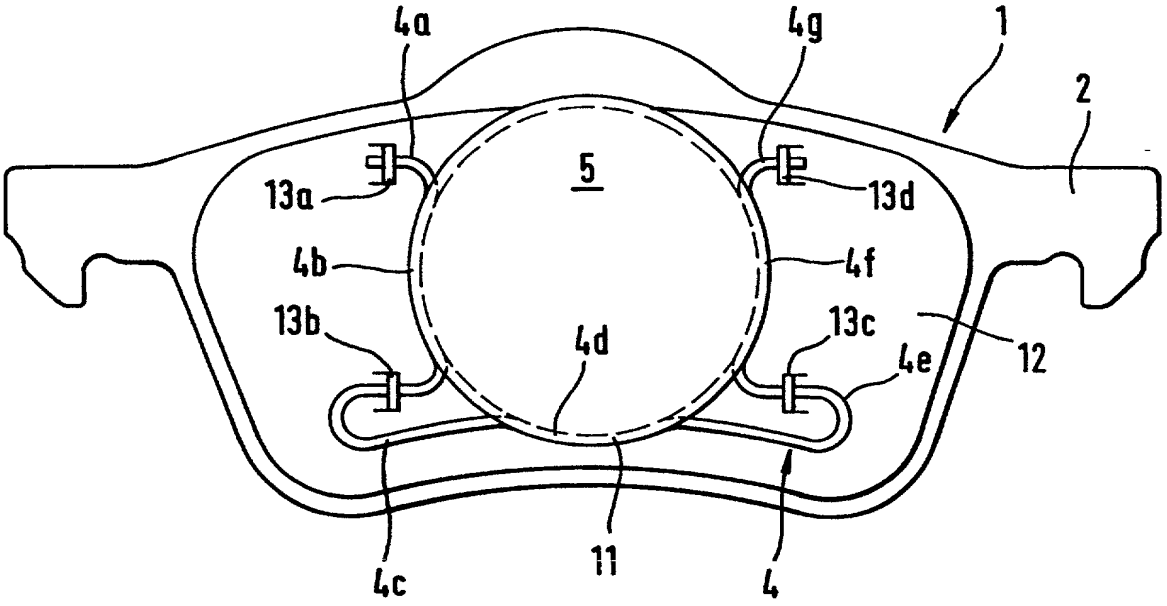


Fig. 3b

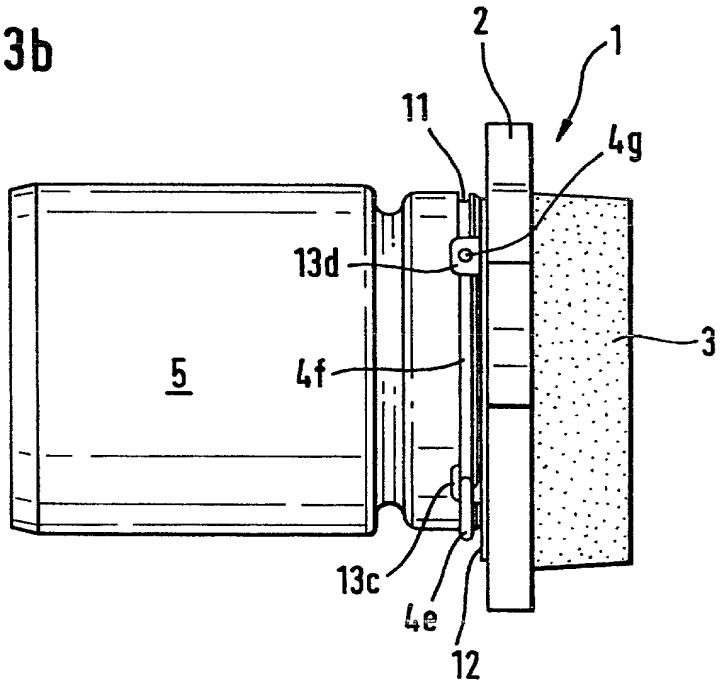


Fig. 4

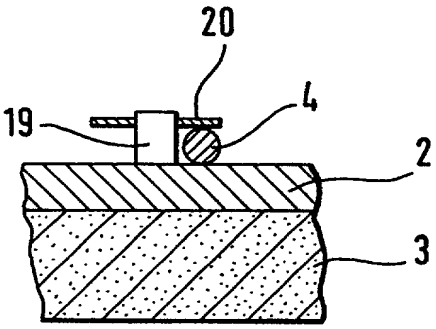
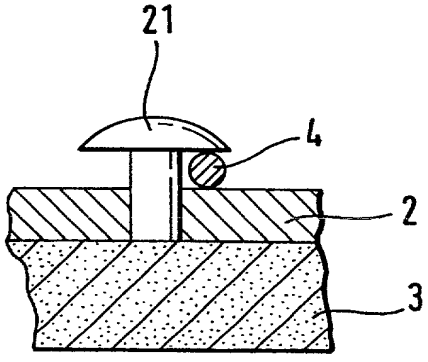


Fig. 5



AP9673

Declaration and Power of Attorney for Patent Application
Erklärung für Patentanmeldungen mit Vollmacht

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As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

Brake Pad Comprising a Retaining Spring Device

the specification of which is attached hereto unless the following box is checked:

☒ was filed on **18/February/2000** ✓
as United States Application Number or PCT International Application Number
PCT/EP00/01373 ✓

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above and as amended in a preliminary amendment.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal
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PTO/SB/103 (8-96)
Approved for use through 9/30/98. OMB 0651-0032
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Prior Foreign Applications (Frühere ausländische Anmeldungen)			Priority Not Claimed Priorität nicht beansprucht
199 06 804.6	**Germany**	**18/February/1999**	☐
199 33 881.7	**Germany**	**22/July/1999**	
Number	Country	Day/Month/Year Filed	☐

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Application No. , filed on

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Application No. , filed on — Status: patented/pending/abandoned)

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Citizen of	**Citizen of**

☐ If box is checked, subsequent inventors are listed on a separate sheet